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ORIGINAL COMMUNICATIONS.

THE BACTERIA.

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"If we were to drop our acquired medical notions, and were to approach the study of disease from the standpoint of the modern naturalist, the germ theory would present itself in a more attractive light. Throughout nature every species of living beings struggles for its existence with all other beings with which it comes in immediate contact. In numerous instances this struggle amounts to the preying of a smaller species upon the body of larger creatures, the former deriving from the organism of their host their means of subsistence."

Prof. H. Gradle.

For years bacteria have been known to exist, but not until the promulgation of the germ theory of disease have they awakened any particular interest in the popular mind. Up to this time they had been studied by but few scientists, consequently the popular idea of their place in nature has been exceedingly vague and indefinite, they being often looked upon as the embodiment of all that is evil, and as

a result of this notion we find more false than true attributes laid to their charge.

In our description of their characteristics we shall make no claim to originality, our object being to give their life history as far as known to the present time; to explain natural facts in simple language, clearly defining the position they now occupy in the scientific world; and also to place before you, as clearly as we are able, the part they now (in the opinion of many of the dental profession) play in the production of dental caries. We have availed ourselves freely of what literature the subject affords, and in some places have found it impossible to give references, as much of the matter has now become the common property of those scientists who have given the subject the most attention.

At the present time some of the most difficult biological questions are those connected with the life history of these organisms; for while touching some of life's most diverse problems they offer without contradiction studies of the greatest interest. For, to study their history is, in truth, nothing less than to be brought face to face with the claims of spontaneous generation, with the chemistry of the fermentations, with the pathology and therapeutics of most of our virulent contagious diseases; and, notwithstanding the efforts of modern science to dispel the dark cloud which still surrounds the origin of life and its preservation, we must, if we would see any glimmerings of light, learn of these, the least of "life's children." However obscure the relations of these inferior organisms may be to the origin of life, their rôle in its continuance is better known. It is a well-known fact that the operation of nature's laboratory is suspended as soon as there is found to be a lack of material to work upon. Organic matter once produced cannot again enter into the current of life's processes until it has undergone new transformations—"produced according to some, favored by others; but, without contradiction accompanied by the development of bacteria; and without wishing to attribute to these organisms a finality which is repugnant to our monistic conception of the universe, it may be said that it is thanks to them that the continuation of life is possible on the surface of the globe." Those botanists who have recently given the subject the most study, agree in defining these organisms, situated as they are on the limit of the animal and vegetable kingdom, as "cells deprived of chlorophyll, of globular, oblong or cylindrical shape, sometimes sinuous and twisted, reproducing themselves by transverse fission,

living isolated or in cellular families, and having affinities which approach them to the algæ and especially to the oscillatoriæ." "In addition to this enumeration, reproduction has been proved in bacillus by spores, and it is altogether probable that other species are reproduced in the same way." But this degree of precision in their history has been reached only through the most diverse vicissitudes, "At one time considered as animals, at another taken for vegetables; transported from the algæ to the fungi; and one author has even gone so far as to refuse them the nature of living beings." When we take into the account the minuteness of their dimensions and the difficulties with which their observation is surrounded, this diversity of opinion is not at all surprising.

"As early as 1675, while examining with his magnifying glasses a drop of putrid water, Leeuwenhock, the father of microscopy, remarked with profound astonishment that it contained a multitude of little globules which moved with agility. The following year he recognized the presence of bacteria in the feces and in tartar from the teeth," and, as we shall learn, if he has not named them, it is easy to assure one's self by the description which he has given of their form and movements that the organisms observed by him are truly *bacteria*, vibrios and perhaps leptothrix. For the first complete exposition and attempt at classification we are indebted to Devaine, who in the year 1868 published the results of his researches in the German Encyclopedia of Medical Sciences; in this classification he enumerates twenty-nine species.

From this date, 1868, the history of bacteria enters upon a new phase. Pasteur began his labors upon the fermentations and their connection with micro-organisms, while the labors of Devaine and Hallier upon the bacteria of Charbon and the micrococci of contagious maladies, called the attention of chemists and of pathologists to these organisms and especially to the bacteria. After Devaine, we find a memoir published by Hoffman in 1869, in which he demonstrates that they are plants having a distinct cellular structure; also that they can only be classed according to their form and size. He rejects the hypothesis of a spontaneous generation in their origin. Speaking of their rôle in the phenomena of the decomposition of organic bodies and in the fermentations, he says "that, with the exception of yeast, and of the acetic and butyric ferments, all the rest is still enveloped in obscurity."

M. Cohn is the naturalist who in our days has occupied himself

the most with the bacteria. His first researches were published in 1853. Twenty years later he commenced the publication of a series of papers upon these organisms, and in 1876 he gave to the public two valuable essays. Up to this time there was nothing like uniformity in their classification and, in the presence of diverse opinions as to their nature and classification, all will acknowledge the truth of the observation of Cohn, when he says: "So long as the makers of microscopes do not place at our disposal much higher powers, we will find ourselves, in the domain of bacteria, in the situation of a traveler who wanders in an unknown country at the hour of twilight, at the moment when the light of day no longer suffices to enable him clearly to distinguish objects, and when he is conscious that, notwithstanding all his precautions, he is liable to lose his way."

The bacteria, as understood to-day by most botanists, consists of unicellular organisms, "the smallest representatives of animated nature commonly classed as the lowest form of fungi." The Germans call them "spaltpilze"—*dividing fungi*—on account of certain peculiarities in their mode of reproduction. When they develop in a liquid in a sufficient quantity they become visible to the naked eye, appearing either as a slight cloud, or gathered in little masses through the liquid, or forming a pellicle on its surface; but the fact of the absence of turbidity in a liquid does not exclude the possibility of their presence. In liquids more dense than water their presence can not be revealed by the naked eye. Sometimes the color some varieties impart to the liquid, although slight and only perceived when a considerable thickness of the liquid is examined, serves to indicate their presence and species. Upon examination of these clouds or accumulations, we find them made up of a multitude of little bodies in the form of minute granules and variously shaped rods, together with algæ and infusorial animals likely to be encountered as inhabitants of the same soil. "They severely tax the powers of the microscope for their sharp definition. The larger rods, when closely grouped, require a power of 100 to 200 diameters—while the finer granules require an amplification of 400 or more for their detection. Bacteria may be mounted for preservation on the usual thin cover glass used by microscopists, and the covers inverted and fastened to the ordinary microscopical slides. First smear the cover glass with the material containing the bacteria and, after drying a few minutes, immerse in strong alcohol to fix the specimen by coagulation of the imbedding substance. Then stain by immersing in common violet

ink (aniline) at least five minutes. Wash in water and mount in a weak aqueous solution of carbolic acid."

The above is the process of Prof. T. J. Burrill, and we have found it the simplest and most satisfactory of any, though we have obtained very good results by mounting after staining in Canada balsam.

Bacteria vary in shape from spherical to oval, cylindrical and thread-like; and of the latter variety we find straight, or crooked, or spiral, flexible or rigid. We often find the spherical ones connected in bead-like strings or chains. The classifications most in use are based on the size and form of the organisms.

It is a matter of history that one discovery grows out of or follows another and cannot appear without its proper antecedent. Thus the microscope had to be invented and brought to a certain degree of perfection before any progress could be made in the study of these organisms. This will become more apparent to the reader when studied in connection with Prof. Burrill's remarks regarding the size of bacteria. "In transverse diameter one twenty-five thousandth of an inch is a very common measurement, while some, including spherical ones, are even less than half this size. Now, a dot one two hundredth of an inch across is barely visible to the eye of most persons, hence, a magnifying power of more than one hundred times across is required to barely see a common-sized *bacterium*. To make out its real shape and any details of structure, ten times the enlargement mentioned is necessary, and not unfrequently as much more as can be secured by the highest possible powers of the microscope. Increase the height of an ordinary man one thousand times, and his head would be more than a mile above the earth, yet under the same magnification one of these organisms would have plenty of room to swim freely, to stand on end and dance up and down in the film of water included between two pieces of flat glass pressed so closely together as to strongly adhere by capillary attraction. From one hundred to two hundred and fifty of them placed side by side would be required to stretch across the ordinary thickness of book paper. They are the smallest living organisms known to man, yet, as we shall see, by no means the least important in the economy of nature." Some naturalists have divided bacteria into groups upon their ability to move or not; but it is now well settled for the greater number that the same species may present itself sometimes in a state of movement, sometimes in a state of repose. The movements are of two kinds—a movement of the corpuscle upon itself, and a movement of transla-

tion. The first is sometimes nothing more than a molecular or *Brownien* movement which occurs in the smallest forms. But at other times it is more extended and consists in a movement of rotation round the axis, or a bending of the body. Prof. Cohn gives us the best description of these movements. After speaking of the two modes of life characterized by repose and by movement, he says: "In certain conditions they are excessively mobile, and when they swarm in a drop of water they present an attractive spectacle similar to that of a swarm of gnats or an ant-hill. They advance swimming, then retreat without turning about or even describing circular lines. At one time they advance with the rapidity of an arrow, at another they turn upon themselves like a top; sometimes they remain motionless for a long time and then dart off like a flash. The long rod bacteria twist their bodies in swimming, sometimes slowly, sometimes with address and agility, as if they tried to force for themselves a passage through obstacles, as the fish seeks its way through aquatic plants. They remain sometimes quiet, as if to repose an instant; suddenly the little rod commences to oscillate and then to swim briskly backwards, to again throw itself forward some instants after. All these movements are accompanied by a second movement analogous to that of a screw which moves in a nut. When the *vibrios* in shape of a gimlet turn rapidly round their axis they produce a singular illusion. One would believe that they twisted like an eel, although they are extremely rigid." The causes of these movements were explained at first in the supposed animal nature of the bacteria, and the movements assimulated consequently to voluntary movement; but this opinion can no longer be sustained, as similar movements are to be seen in a great number of vegetable organisms, such as diatoms, the oscillatoriæ, the spores of algæ and some fungi, etc. "No one, having seen these motions, can doubt the inherent power the little things possess, or can question their right to be classed as living objects; whether as animals or plants will depend on his previous information and experience, as well as upon what he sees. How they move, that is by what sort of organs or mechanism, is not easy to make out; but they have this power only when immersed in a fluid medium. When dry, they are motionless except as carried by external agents, as air currents."

"The simple structure of a *bacterium* is a minute cell with an outer cellular wall enclosing the protoplasmic contents. There are no organs or appendages, save in some, and perhaps all motile forms, there is at one, or at most, two points, an exceedingly fine, hair-like

appendage, to the vibrations of which the movement of the organism is attributed. This fine *cilium* or *flagellum*, as it is called, is a difficult thing to see, even with the best microscopic equipment and most expert manipulation, partly on account of its exceeding fineness or thinness, partly from its rapid vibrations. Sometimes by introducing a weak solution of iodine, so as to gradually subdue the movement, the cilium can be made out when not practicable otherwise."

Bacteria increase by fission. There is nothing like sexual differentiation, nor is there in the development anything like the germination of a seed. Under proper conditions of nourishment and temperature, each rod or granule elongates and then divides into two. We often find the young organisms thus formed attached to each other partially or wholly, forming chains and threads. If the division occurs in more than one direction, groups are formed. The multiplication by *fission* continues until the soil is exhausted, or until the waste products of the bacterial tissue-change accumulate to a poisonous extent. Fission is not the only mode of reproduction. Propagation by spores can be observed in all the larger forms of bacilli. Continued vegetation without change of soil is usually terminated by the formation of spores, and these spores as a rule will not germinate in the unchanged soil where they were produced. The formation of spores is a criterion by which bacteria has been assigned to the vegetable kingdom. In animals, the appearance of germs is never coincident with the death of the parent, which mode of reproduction is quite common among plants."

As to their classification, Sachs seems to have solved the question by uniting the algæ and fungi in a single group, the *Thalophytes*, in which he establishes two parallel series, one comprising forms possessing chlorophyll, the other, forms destitute of it.

[To be continued.]

EARLY HISTORY OF THE MASSACHUSETTS DENTAL SOCIETY.

BY J. T. CODMAN, D. D. S., BOSTON, MASS.

[Address delivered before the Massachusetts Dental Society, at its Annual Meeting, in Boston, December, 1883.

The Massachusetts Dental Society, whose nineteenth annual meeting we hold to-day, was formed in the following simple manner:

In the month of February, 1864, two dentists accidentally met in the dental depot of S. S. White, and, while conversing on the subject of the want of union and brotherly feeling among dentists, and how they reviled one another when they should harmonize, help and sustain each other, one of them then said: Will you be one of six to form a dental society? On giving his assent, the other one called on Drs. Chandler, Ham, Harriman, W. W. Pray, E. N. Harris, and others, to the number of twelve, asking them to meet together. The result was a first meeting. The two dentists who met at the depot were Drs. D. G. Harrington and S. J. McDougall, Dr. S. J. McDougall taking special pains to interview the parties named, and others who are not now recalled.

The *first meeting* of dentists interested in forming a dental society in Boston was at the rooms of the Young Men's Christian Association, in the old Tremont Temple building, opposite the Tremont House. It was held in a moderate sized committee room off from the reading room, where the meetings were ofttimes o'ershadowed, shall I say disturbed, by the hymns of praise that reached our quarters from the adjoining room. It was called to order, and organized by the choice of Dr. Ira A. Salmon as chairman, and Dr. S. J. McDougall as secretary, and a committee was appointed to draft a constitution, consisting of Drs. I. A. Salmon, T. B. Hitchcock, S. F. Ham, G. B. Harriman and S. J. McDougall. Dr. Salmon was requested to act as chairman, and Dr. McDougall as secretary, until the annual meeting was had which was in contemplation. The date of this meeting was March 4, 1864.

Constitution-making was early begun—March 24, on which was the next meeting but one, the preamble and constitution were adopted. Drs. E. C. Rolfe, I. J. Wetherbee, E. N. Harris, S. J. McDougall, and G. B. Harriman were appointed an executive committee to act until the annual meeting. Eleven members signed the constitution, and paid the admission fee.

At the next meeting, seven new names were proposed, among them Dr. N. C. Keep, a prominent and conservative dentist of Boston,

and the first discussion was had. It was on the subject of nitrous oxide gas, and is on the records as "interesting," and that is all that is said about it. The society then adjourned for one month.

At the next meeting, there were five new members proposed, Drs. Edwin S. Blake, Elisha G. Tucker, John T. Codman, of Boston, W. Irving Thayer of Chelsea, and A. Papineau of Waltham.

Drs. Thomas H. Chandler, Keep, and Wetherbee were appointed a committee on a seal.

The first annual meeting was held May 6, 1864. The Brothers Cook of Milford, H. F. Bishop of Worcester, and B. T. Currier of Boston, were admitted. The first board of officers was as follows:

N. C. Keep, President; I. J. Wetherbee, Vice President; T. H. Chandler, Recording Secretary; E. C. Rolfe, Corresponding Secretary; S. J. McDougall, Treasurer; E. H. Harris, Librarian; I. A. Salmon, S. A. Cook, B. S. Codman, H. F. Bishop, T. B. Hitchcock, Executive Committee.

Drs. Rolfe, Hitchcock, and Cook were appointed a committee to nominate an orator to deliver the annual address, and the choice fell on N. C. Keep, M. D.

At the next meeting, among the matters of business, it was

Voted, To send a copy of the constitution to every dentist in the State. The subject of plugging teeth was assigned, in July, for the next meeting, but instead a preamble and resolutions came up inciting the society to solicit the co-operation of all dental societies and individuals to test the validity of the Cummings patent, in such form and manner as the exigencies of the case demand.

At the next meeting, September 19, Dr. Ambrose Lawrence, of Lowell, proposed the establishing of a dental journal, and a committee was appointed on the subject. A committee was also appointed to give notice of intention to apply for an act of incorporation. Dr. Wetherbee proposed the establishing of a dental college under the auspices of the society.

At the October meeting, Drs. C. G. Davis, E. G. Leach, and J. H. Batchelder were elected to membership.

November 7, the committee on dental journal reported that in consequence of the disturbed state of the country, and the high price of materials and labor, it is inexpedient to act in the matter, and that the committee be discharged.

At the December meeting, our worthy friend, Dr. F. Searle, of Springfield, was elected, and a committee was appointed to report on a scale of fees.

At the January meeting, a committee of three was appointed to petition Congress not to extend the Goodyear patent.

At the February meeting, Dr. L. D. Shepard was elected to membership. It was also resolved that we consider the formation of the U. S. Dental Protective Union opportune, and do, as a society, consider it a privilege, as well as a duty, to aid said society by becoming members of it.

Thus far, the Massachusetts Dental Society went under the title of the Massachusetts Dental Association. In order to make its name conform with other similar organizations, by advice of the legislative committee who had the matter of its incorporation in charge, it was

Voted, To change the word Association to "Society," and it was incorporated under that name April 1, 1865.

At the second annual meeting but little change was made in its officers, Dr. Keep being re-elected president. Drs. Salmon, Cook, and B. S. Codman went out of the executive committee, and Drs. Lawrence, Ham, and J. T. Codman entered on its duties.

1865. Dr. Keep delivered the annual address, and Dr. Wetherbee was appointed the next orator. The first social meeting is here recorded. Dinner was had at the Tremont House, each member paying for his ticket $1.50. I find no note of the dinner, however, except that the report of the committee on collation was accepted. I find that the first written essay (excepting the annual address) was by Dr. Wetherbee, on Mallet Plugging; the next was by Dr. Ambrose Lawrence, subject not stated.

At the November meeting, on motion of Dr. Wetherbee,

Voted, That a committee of three be appointed to take under advisement the establishment of a chair of dentistry in the Massachusetts Medical College, in accordance with the recommendation of the President, in his annual address, and to take such action as the matter demands, and, by nomination at large, Drs. Keep, Wetherbee, and Chandler were appointed that committee. The society was now fully established, and the recording secretary evidently felt quite genial when he put on record that "the old subject of Mallet Filling again came up." A tooth was filled by hand-pressure, by Dr. Wetherbee, and tested with a mallet by Dr. Salmon. Afterwards, a piece of pure gold plate was tested, by mallet and hand-pressure, and shown to a committee to decide which holes were the deepest, who reported that "*some holes were deeper than others.*" Report accepted, and meeting adjourned. Dr. McQuillen, of Philadelphia, delivered a lecture

on Audition and its connection with Dentistry, and Dr. Atkinson, of New York, paid us his first visit.

At the February meeting, the following essayists were appointed, and I am happy to say that they nearly all fulfilled their pledges; if not, some one took their places:

April. Dr. Keep: A New Method of Anæsthesia by Local Freezing.
May. Dr. Chandler.
June. Dr. Harris: Professional Fees.
July. Dr. Gerry.
Sept. Dr. Salmon: Conservative Dentistry.
Oct. Dr. Leach: Alveolar Abscess.
Nov. Dr. Goddard. (Dr. Harrington): Duties of the Dentist.
Dec. Dr. McDougall: The Dignity of the Profession.

At the March meeting, Dr. Moffatt was elected member.

1866. At the third annual meeting, Dr. Keep was re-elected president, Dr. Wetherbee delivering the annual address.

I pass hastily on. The American Dental Association had voted to hold its annual meeting in Boston. A subscription was started to entertain the members of it and $250 was raised on the spot.

At a special meeting, October 22, 1866, called by request of five members, the matter of a building for the society was started and it was

Voted, That the officers be directed to memorialize the Legislature for authority to hold property to the amount of $50,000.

The meeting of the American Dental Association in Boston was a great success. The report of the committee states that the amount subscribed and paid in was $1,160.30, and the amount paid out, $1,062.50, leaving in the hands of the treasurer, $97.80, which balance was paid in to the treasury of the Massachusetts Dental Society.

For nearly three years we were without a Code of Ethics. At the December meeting, it was

Voted, To adopt the Code as adopted by the American Dental Association.

At the January meeting, the subject of the essay and discussion was "Alleged Poisoning by Nitrous Oxide," which resulted in the appointing of a committee of five to investigate the whole subject—the secretary calls it "a committee of gas." Drs. Hitchcock, Keep, McDougall, J. T. Codman, and Salmon were that committee. Drs. Lawrence and Wetherbee presented the society with 500 copies of the Code of Ethics for general distribution, receiving a vote of thanks. At this meeting, it was

Resolved, That this society approve of the establishment of a New England Magazine, to be conducted by a board of editors, and that the New England dental societies be invited to unite in establishing such a publication by electing one of its members to the board of editors. A committee of five was also appointed to remonstrate against granting a charter to the Dental Vulcanizing Company, and again a list of essayists was made out for each month in the year.

1867.	March.	Dr. J. H. Batchelder, Salem.
	April.	A. S. Cook, Milford.
	May.	S. P. Miller, Worcester.
	June.	Dr. S. F. Ham, Boston.
	July.	C F. Horne, Watertown.
	Sept.	W. W. Russell, Haverhill.
	Oct.	C. G. Davis, New Bedford.
	Nov.	Dr. G. T. Moffatt, Boston.
	Dec.	D. G. Harrington, South Boston.
1868.	Jan.	O. F. Harris, Worcester.

April 1, 1867. On the report of the committee on dental college being called for, Dr. Keep reported that the committee had attended to its duties; it had several meetings with the committee of the medical faculty, Drs. Bowdich, Bigelow, and Ellis, and that a plan had been decided on which had been unanimously adopted by the medical faculty. I now call the attention of our society to the following resolutions, which were introduced by Dr. Hitchcock and adopted at this same meeting.

Whereas, The Massachusetts Dental Society has adopted a Code of Ethics for the government of its members; and,

Whereas, It is essential that the provisions contained therein shall be conformed to by its members; therefore, be it

Resolved. First. It shall be the duty of members to report any violations of the Code of Ethics which may come to their knowledge to the executive committee.

Second. When the executive committee shall know of any violation of the Code it shall be their duty, and they are hereby instructed, to report such cases to the society.

Third. Should the executive committee report any member as having violated the Code, it shall be the duty of the secretary to immediately call his attention to it, with the request that it shall not be again violated.

Fourth. Should said member, after having his attention called to

the offense, still continue to repeat the violation, he shall be proceeded against by the executive committee, as provided in the By-Laws, Article VI., Section 2.

The project of a building, with hall for the society in it, was still on the carpet. Dr. McDougall had introduced to the society a superior gold foil, manufactured under his own supervision, and had also announced to it that he would give all the profits of its manufacture for one year to the society towards the building fund. Circumstances did not favor the manufacture and sale of a large quantity of it, but at this meeting Dr. Leach made a report of profit on gold foil sold by Dr. McDougall of $102.70, which he very generously donated to the society. After this time, when the building project was given up, by his request it was transferred to the general fund. Dr. Hitchcock then moved a vote of thanks with an invitation to other foil-makers to do likewise. Dr. Atkinson, of New York, read a paper on Histology. A collection was then taken up for his benefit, which amounted to $18, for which he returned thanks.

1867. At the fourth annual meeting clinics were given by Drs. McDougall, Moffatt, Hitchcock, and J. T. Codman. This meeting was at the rooms of the Massachusetts Medical Society, in Temple Place, in the savings bank building, which thenceforth became the place of meeting. Dr. Keep declined a re-election, and Dr. Leach became president. Two vice-presidents were chosen, as by the amendment introduced, Dr. Bishop of Worcester, and Dr. Harris of Boston; Dr. J. T. Codman, secretary, and Dr. Chandler, orator. Progress was reported in the matter of the New England Magazine. The plan was adopted by the Connecticut State, Connecticut Valley, Maine State, Merrimack Valley, and our own society. Everything seemed favorable to an early issue, and it was voted to refer the publication of Dr. Bishop's address to the executive committee in expectation that it would appear in the new magazine. Dr. T. H. Chandler had been elected editor-in-chief. It was also requested that Dr. Chandler prepare a paper on the early history of this society.

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At the October meeting, Dr. Wetherbee stated that the hand could condense a filling equally well as the mallet. Dr. Leach took up the statement, and offered a challenge to him, which resulted in a trial before a committee appointed for that purpose. The result was that Dr. Wetherbee's hand filling weighed twenty-four grains, and Dr. Leach's twenty-eight grains, and was made with Dr. Salmon's auto-

matic mallet. At this same meeting, $175 were appropriated out of the treasury for a microscope.

The society now inaugurated monthly social meetings at the houses of members. The first was held at Dr. Hitchcock's and the second at Dr. McDougall's.

I find that at the January meeting the new cabinet was announced as ready for contributions.

At the May meeting, various gentlemen gave their narrations of transplanted teeth. Dr. Coggswell led off, followed by Drs. Leach, Chandler, Keep, and Bishop, after which Dr. McDougall related a case where some teeth were displaced for considerable time, then replanted, and lasted fifty years, he having seen the patient with the teeth in, and he had knowledge of her truthfulness. It is related that "Dr. Waters told a larger story but did not show the patient!"

I now come to a pause in my sketch. You have seen that the men who were the life and soul of this young society were in dead earnest and that the society was full of life and activity, and full of projects of prime importance to the dental profession. A closer scrutiny of the records will show this fact to better advantage. It will show that the society had its list of subjects for discussion prepared in advance, and volunteers engaged, and as we look back we shall see what good it has accomplished. Out of chaos a great deal of order had come. The society had made a place for itself in the profession and in popular esteem. It had organized a dental college in our midst. It had obtained certain professional and legal rights, and was the owner of some working material. But a spirit of rivalry was growing up in its midst that did not provoke a closer union of its members, and a greater unity, but led the ambitious to seek to secure personal ends not always in harmony with its methods. Its period of change had now come. It was a State society, and called its members from long distances to Boston, to its meetings, but the personal squabbles of its Boston members induced its country members to forego its meetings.

Harris had withdrawn and was working up a new society with Wilson, Clough, and Tucker at its head. Wetherbee had struck a blow at the project of a dental college by going to the Legislature for the incorporation of a new society, and so it came to pass that the social meetings were first given up, then the monthly ones were changed to an annual and semi-annual meeting. The building project had come to naught, and the editor-in-chief of the New England Dental Magazine reported that "no material" for it had come to hand, and, consequently, the subject was dropped.

But these changes came gradually. In July, 1872, it was voted to give up the hall we occupied, and the monthly meetings were held at various dental offices of the members in Boston. In March, 1873, the society adjourned to the semi-annual meeting. It was held in Worcester. There the Connecticut Valley Association was in session, and a union meeting was held. Seventeen new members were added to the list of this society, and at its close the secretary was instructed to communicate to the Connecticut Valley Dental Association "our congratulations at the success of the union meeting, and the pleasure which this society has had in meeting with them."

The tenth annual meeting, 1873, was held in December, at the Meionean Hall, Tremont Temple. A recent death by chloroform gave the text and, with the exception of time taken for the annual address, the whole day was devoted to the discussion of the question of chloroform administration. After two sets of resolutions had been presented, the society finally passed the following:

Resolved, That in the opinion of the Massachusetts Dental Society, the use of chloroform in dental operations is not justifiable, and that the public should be advised to shun such practitioners as persist in using chloroform as an anæsthetic. Nineteen active members were admitted, and two corresponding members. Dr. Moffatt was elected president, succeeding Dr. Batchelder.

At the eleventh annual meeting, Dr. J. S. Hurlbut, of Springfield, was elected president, and the following preamble and resolution was passed:

Whereas, Certain persons in our profession persist in administering chloroform in dental operations, notwithstanding its well known dangerous tendency; therefore,

Resolved, That the members of the Massachusetts Dental Society do emphatically condemn the use of chloroform as an anæsthetic, and any member of this society who shall administer chloroform hereafter shall be liable to expulsion.

At the semi-annual meeting, which was held at Lawrence, resolutions were passed on the death of T. B. Hitchcock, M. D.

At the twelfth annual meeting, resolutions were passed on the death of Drs. Keep and Rolfe. Dr. J. T. Codman was elected president, and Dr. J. S. Hurlbut orator, who afterwards resigned, being away in Europe. Dr. R. R. Andrews was his substitute, and read his address before the society, in the rooms of the Christian Union, in Boylston street.

The twelfth semi-annual meeting was held in Salem, at the Essex Institute, June 7, 1877, and to my mind it marks an era in the history of our society. It was a well-conducted meeting. Dr. Batchelder, who was chairman of the executive committee, was ambitious to have a good meeting in the city where he was in practice. I had been elected to the executive committee, after a long absence, and used my endeavors to bring up the meetings, which had deteriorated in character and ability, to the former standard; to frown on the spirit of clique by giving work to the society in the reading and discussing of professional papers, by striving to add to the spirit of good fellowship already existing, and keeping in the background all personal jealousies and grievances. Seven good original essays were delivered, and when the meeting adjourned it gave a hope to all that better prospects and better times were in store for the old Massachusetts Dental Society. . . . . .

The seed planted at this time bore good fruit. At the annual meeting, held at the Tremont House, by the exertions of the executive committee in securing good quarters and reliable essayists, the membership began to increase. It then numbered 58 members in good standing. At the next two meetings the number added was 39. A number of these were members who had left the society and returned to it. At this meeting, the society invited all the other societies to meet with them at the semi-annual meeting, in joint convention. A very successful meeting was the result, and comprised the New Hampshire Dental Society, Connecticut Dental Society, Maine Dental Society, Vermont Dental Society, Rhode Island Dental Society, Connecticut Valley Dental Society, American Academy of Dental Science, Merrimac Valley Dental Society, Boston Society of Dental Improvement, and the Harvard Odontological Society.

I now leave these records, remarking only that all of these societies, with two exceptions, were formed at a later date than the Massachusetts society. The temptation to continue these notes and extracts is great, but I forbear, as I wish to tabulate some of its proceedings, and as the later history of this society, which I was not asked to speak of, is pretty well known to you. The greatest important society lesson taught by its proceeding is that when its officers and members attend to its legitimate duties as a society devoted to dental science, and the education of its members, socially and professionally, it prospers; and when they stand on close ethics, and hold a tight rein over the private judgment of the duties of members

as toward the profession, or when members have their private axes to grind, it loses its strength, its members give it the "cold shoulder," and its usefulness wanes.

It is hardly necessary that I should say that much good has been done by the formation of the Massachusetts Dental Society; that it was formed during the war, and that the many wise projects it inaugurated failed—some of them because of the unpropitious times, some because the projectors of them were too sanguine and had not wisely estimated their cost, and some because they had too much of personality mixed with them. It has been of very much use to the members of the dental profession in Massachusetts, and its influence has extended far beyond the borders of our ancient Commonwealth; but however much it has been of use to dentists it has been, as we know, of far greater use to the great community we dwell in. From its organization have sprung two schools of dentistry, not, however, bearing or professing any marked difference in styles of instruction. Whether or no it would have been wiser for this mother to have borne only one child, instead of two, it is not for me now to give an opinion. They survive—one bears the proud name of Harvard, and the other the name of my native city, Boston. My wish, your wish, all our wishes, should be that they shall devote all their energies to one common end: the elevation of professional standing of the coming generation of dentists.

WHAT IS THE TRUE HISTORY OF THE USE OF THE RUBBER DAM?

BY WM. T. La ROCHE, D. D. S.

This is a question that it is my intention to answer by giving the facts that are of my own personal knowledge and the testimony of those with whom my knowledge is connected—links in the chain. Right here it may be quite pertinently asked why I do this and at this time. My answer is this: In May, 1876, after a residence out of the city of over eleven years, during which time I had been able to attend I think but one dental meeting, I returned to New York. Some time thereafter I met my friend, Dr. J. W. Clowes, at a meeting held at a friend's residence and, among other things, the subject of a rubber dam was spoken of by us. I then remarked to him: "Doctor, I have read in the *Cosmos* that you stated at one of the meetings that you believed you were the first to use the rubber dam in this city; now, you are mistaken in that. I believe I was the first

to use the rubber dam." The conversation was brief and, after it was over, I gave the matter no further thought at the time. I certainly did not imagine for one instant that this little passing conversation would create the discussion and tend to cause the contention in the profession that it apparently has. Nothing could possibly have been more foreign to my intention.

Dr. Clowes, no doubt assuming that I must possess evidence to support my claim, and information relating thereto that might be interesting, wrote to me in December, 1877, kindly inviting me to meet several professional brethren at his house and to give them such information as I possessed concerning this matter. At a meeting subsequently held, as a result of this invitation, after the subject had been brought up by him, upon his request for a statement from me, I complied, by stating in substance that I firmly and conscientiously believed that I was the first to invent, introduce and use the rubber dam as applied in dentistry; that while upon so short and unexpected notice I was not prepared to adduce competent and satisfactory evidence thereof, yet, nevertheless, I felt very certain that, within a reasonable time, I could produce such evidence and fully prove my assertion to be true. Since then, as many of you are doubtless aware, this question has been brought up at various times and places, and still continues to arise. It must be settled. Let the whole truth of this matter be known, and *now*. If I could, I would always avoid doing any act or saying anything that might provoke a discussion involving delicate questions of this character, or that could evoke any unfriendly feeling or spirit. Rather than do so, though again and again urged to speak, I have remained patiently silent and would still continue silent, but this matter has now assumed such proportions and portent that, knowing I am right, with the truth on my side, I cannot and will not stand in a false light before the profession any longer. A due respect for myself and my word demands this. Justice is all I seek; honors I ask of none. All I ask is to fully and fairly state my case to you upon its own merits. If my claim is a mistaken one, if the credit justly belongs to another, then no one will be more willing to do him honor than I.

When I came to New York, in 1849, and before commencing the study of dentistry I was, during part of that year and for the three next succeeding years, in the employ of Messrs. Van Duzen, Jagger & Co., a firm then doing a large dry-goods business in this city. Some two years of the time I was thus employed I spent my evenings

in the office of a dentist, studying and working at mechanical dentistry, during which time I frequently made a set of teeth for and sold a bill of goods to the same man. In April, 1852, I left their employ and commenced the practice of dentistry. In the store of this firm the Goodyear Rubber Glove Company had an office. Naturally, I became acquainted with the representatives of this company, and also quite familiar with the rubber material manufactured and used by them. This association was the germ of my use of the rubber dam; it was from this company that I subsequently obtained the first rubber to use for a dam. The exact day and month when I first used a rubber dam I cannot now state, but I do know it was used by me in 1857; to that fact I am ready to make an affidavit at any time. Now for my proof: It consists of the following affidavits from patients and former students of mine. You will observe that most of these deponents live right here in this city. I think most any unprejudiced man must admit that there is sufficient evidence here submitted to absolutely justify and vindicate me and to prove with reasonable certainty that my assertion that I first invented, introduced and used the rubber dam, had for its foundation the truth.

City and County of New York, ss.

William A. Skidmore, being duly sworn, says that in the month of December, 1857, William T. La Roche filled certain teeth for deponent; that at that time the said William T. La Roche made use of a piece of thin rubber cloth with a very small opening cut therein through which the tooth to be filled was pushed for the purpose of keeping the cavity in such tooth dry while being filled. Deponent further says that he knows that in 1850 said William T. La Roche was employed by Van Duzen, Jagger & Co., and that a rubber glove company then had an office in the store of the aforesaid firm in the city of New York.

WILLIAM A. SKIDMORE.

Sworn to before me this 14th day of March, 1883.

JOSHUA KANTROWITZ, Com. of Deeds, N. Y. Co.

STATE OF NEW YORK, *City and County of New York, ss.*

George B. Haines, being duly sworn, deposes and says that he resides in the city of New York; that in the month of March, in the year 1857, Wm. T. La Roche filled a certain tooth for this deponent; that deponent knows that at said time William T. La Roche used a piece of thin rubber material or cloth for the purpose of keeping the cavity in said tooth dry during the operation of filling the same by cutting a hole in the said rubber material or cloth and forcing the tooth about to be filled through the hole so made.

GEO. B. HAINES, 215 West 53d street.

Sworn to before me this 27th day of April, 1883.

R. P. H. ABILL, 16, Notary Public, N. Y. Co.

STATE OF NEW YORK, *City and County of New York, ss.*

Francis F. Reynolds, being duly sworn, deposes and says that he resides in the city of New York; that in 1857 and 1858 deponent was a student in the office of William T. La Roche, at 191 Bleecker street, in said city; that at and during said time, namely 1857 and 1858, deponent knows that said William T. La Roche did use a rubber cloth or dam for the purpose of keeping certain cavities in teeth dry during the operation of filling them; that the manner of using said rubber dam was as follows: A small hole was cut in a piece of thin rubber cloth, the tooth about to be filled was forced through the aperture so made, and the tooth thus kept from contact with any wet surfaces; that deponent frequently saw said William T. La Roche use rubber cloth in such manner for such purposes. Deponent further says that at the above time mentioned William C. Tinker was also a student in said office.

FRANCIS F. REYNOLDS.

Sworn to before me this 26th day of February, 1883.

GEO. R. WESTERFIELD, Notary Public, N. Y. Co.

STATE OF NEW YORK, *City and County of New York, ss.*

Elizabeth A. Yale, being duly sworn, deposes and says that she resides in the city of New York; that in the month of September, in the year 1859, William T. La Roche, dentist, No. 191 Bleecker street, filled a certain tooth for deponent; that deponent knows that at said time said William T. La Roche used a piece of thin rubber material or cloth for the purpose of keeping the cavity in said tooth dry during the operation of filling the same by cutting a hole in the said rubber material or cloth and forcing the tooth about to be filled through the hole so made.

ELIZABETH A. YALE, 248 West 53d street.

Sworn to before me this 27th day of April, 1883.

R. P. H. ABILL, 16, Notary Public, N. Y. Co.

STATE OF NEW YORK, *City and County of New York, ss.*

Richard Morary, being duly sworn, deposes and says that he resides in the city of Havana, Cuba, and is a practicing dentist; that in and during the years 1859 and 1860 deponent was a student in the office of William T. La Roche, in the city of New York; that at and during said time, to wit, 1859 and 1860, deponent frequently saw said William T. La Roche use a rubber cloth or dam for the purpose of keeping certain cavities in teeth dry during the operation of filling them; that said William T. La Roche did at that time, to wit, 1859 and 1860, instruct deponent in the use and proper application of the said rubber dam. Deponent further says that the use of the rubber dam as then and at that time made by said William T. La Roche was and is practically and substantially the same as is now in general use in the dental profession.

RICHARD MORARY.

Sworn to before me this 8th day of October, 1883.

GEO. R. WESTERFIELD, Notary Public, N. Y. Co.

City and County of New York, ss.

Helen F. Biddle, being duly sworn, says that she resides in the city of New York; that in the month of December, 1862, at No. 191 Bleecker street, in said city, William T. La Roche filled certain teeth for deponent; that deponent knows that at said time, for the purpose of keeping certain cavities in deponent's teeth dry during the operation of filling them, said William T. La Roche used a kind of rubber cloth through a hole in which he pushed the tooth having such cavity. Deponent further says that she still retains the teeth so filled as aforesaid.

HELEN F. BIDDLE, 35 West 55th street.

Sworn to before me this 27th day of April, 1883.

R. P. H. ABILL, 16, Notary Public, N. Y. Co.

STATE OF NEW YORK, *City and County of New York, ss.*

James M. Gano, being duly sworn, deposes and says that he resides in the city of New York and is a practicing dentist; that in and during the years 1863 and 1864 he was a student in the office of William T. La Roche, in the aforesaid city; that at and during the said time, to wit, 1863 and 1864, this deponent did frequently see and witness the said William T. La Roche make use of rubber cloth or dam for the purpose of keeping certain cavities in teeth dry during the operation of filling the same; that said William T. La Roche did, at the aforesaid time, instruct deponent in the proper method of application and use of the rubber dam as aforesaid. Deponent further says that the use of the rubber dam as then and at that time made by the said William T. La Roche was and is practically and substantially the same as is now in general use in the profession.

JAS. M. GANO.

Sworn to before me this 11th day of October, 1883.

BENJAMIN A. MORAN, Notary Public, N. Y. Co., No. 176.

STATE OF NEW YORK, *City and County of New York, ss.*

Oren D. Pomeroy, being duly sworn, deposes and says that he resides in the city of New York and is an oculist; that from September, 1864, until April, 1865, inclusive, deponent attended William T. La Roche professionally; that at and during all of said time said William T. La Roche was suffering with opthalmia; that deponent knows that William T. La Roche at said time was, by reason of his said disease, totally unable to use his eyes for the purpose of reading.

OREN D. POMEROY, M. D.

Sworn to before me this 12th day of October, 1883.

ARTHUR FITCH, Notary Public, 69, New York Co.

CLEANLINESS.

BY HYMAN ROSA, M. D. S., KINGSTON, N. Y.

If the old adage be true that "Cleanliness is next to godliness," it is equally true that many dentists of the present day are very far away from godliness.

While it is not to be supposed that many gentlemen before me require a lecture upon refined manners and tidy habits, yet it is painfully true that many of our profession need just this very lecture upon a principle which is among the most important, if not *the most radical one of our calling*, and to which they would appear to be almost total strangers.

If the dentist does not possess sufficient means to furnish his office elegantly, he can certainly give it an air of cleanliness, and there is little excuse for allowing unsightly objects to confront and impress our patients at first sight with feelings of disgust. That this matter is not sufficiently considered by a large number of our brethren, proofs are very abundant.

There is no excuse for furniture covered with dust; carpets littered and unswept, or spittoons bespattered and unsightly with blood from a previous victim. There is no good reason why a dentist should not have a bountiful supply of clean napkins, towels and rubber dam. There is no good excuse for a dentist not thoroughly cleaning his forceps, his excavators, or his scalers and separating files. There is nothing to prevent a dentist from washing his hands and cleaning his nails before putting them in a patient's mouth. In fact, there is no reason why a dentist should not be as near perfection, in these preliminaries, as possible.

We are, to a great degree, *the educators* of our patients. If our habits are loose, our personal appearance untidy, and our operating room in a shabby and dirty state, we cannot complain if our patients are careless in their treatment of our place and its appurtenances; if our hands and face and mouth are unclean, we dare not chide them for duty neglected and unperformed. Then, also, if a dentist is particular in keeping his office and its appurtenances neat and orderly, we feel he will be particular in having his operations thoroughly performed, and such an one will be most likely to gain confidence and esteem, even among entire strangers. In personal appearance, it is not necessary that a professional man should dress like a fop; but clean linen and suitable attention to the toilet add much to personal charms.

Our patients are usually more observing than we suppose, and sometimes notice things that reflect unfavorably upon us; hence, we need be ever on the alert, and see that our manners, our apparel and our office appointments are such as will bear scrutiny or defy criticism.

It was my privilege to visit the New York College of Dentistry, a short time since, and though I say it somewhat reluctantly, it is no less true, that it was about the dirtiest place and the most slovenly lot of persons I could conceive to be engaged in teaching the principles of dentistry, much less *its practice*. The demonstrators of operative dentistry were not bad-looking individuals, but their personal appearance was decidedly against them, in my estimation. Greasy, shiny coats; linen spotted and soiled, hands grimy, and "nails with dirt enough under them in which to plant potatoes," as we used to say when we were boys. Of course, the students, with such examples daily in their midst, were largely on the same plane with the demonstrators, and is it at all strange that, being with them from day to day in association, they should experience—perhaps unconsciously—an assimilation?*

Lastly, dentists should be clean and neat for *sanitary reasons*. Many diseases can be conveyed through the agency of instruments or appliances infected therewith. Instruments used in the mouth should always be washed thoroughly, and if any doubt exists in the mind of the operator concerning the presence of any contagious malady, the instruments should be disinfected by dipping them in a mild solution of carbolic acid and water.

Brethren, facts, like mules, are ofttimes stubborn things; but it becomes us, as professional men, as professional artists, and as professional teachers, to see to it that these important points be not slighted or overlooked. There is no need of mincing matters, and calling slovenliness *a manifestation of genius*, or dirt and disorder *the evidence of a good practice*. Carelessness and filthiness need no second invitation in a busy dentist's office—*we know* something about that. They are, therefore, no good evidence of professional fitness but, as I have attempted to prove, are often the standard by which the proficiency of a dentist is judged. Let us, then, carefully guard this avenue of our reputation, and by precept and example be diligent advocates and supporters of the habit of cleanliness.

*We are sorry to have heard precisely the same statements from others who have visited the above-named college. It is a blemish undoubtedly too common with all our colleges, but one that should be removed. Students cannot be too sharply or too persistently made to feel the importance of *absolute cleanliness* of person, office, and all instruments in daily use; and if the colleges *practically* educate (?) them in the opposite direction, it is nothing less than a gross wrong, to students at least.—*Ed.*

EDITORIAL.

ANOTHER WORD ABOUT ANTISEPTICS.

Dr. R. F. Weir, speaking before the New York Academy of Medicine, on this subject, said: "Since the researches of Koch, Kümmel, and others, we now have very clear ideas on the subject (the use of corrosive sublimate as an antiseptic). It had seemed to him the acme of an antiseptic for surgical purposes, efficient, safe, cheap; but, during the last few days, he had discovered that it was not entirely free from objection, since its solution was not durable. In the course of one or two weeks it became changed to calomel, as he had found by testing surgical dressings saturated with it with lime water. A few days since he had written to Professor Gibbs, of Harvard University, in regard to the matter, and had just received a reply, in which he said he thought the solution of bichloride might be made durable by the addition of a small quantity of common salt, say five parts in a thousand. He proposed, however, to make further investigation on the subject. . . . . The solution employed was bichloride of mercury 20 parts; water, 44,480 parts; glycerine, 500 parts. It was sometimes used as strong as one to 1,000. The glycerine is added to prevent the gauze from entirely drying, as it becomes a little weakened when entirely dry."

This is speaking, of course, of surgical dressings, and has no reference directly to its use in the mouth. It is interesting, however, to the dentist, as showing the direction of the latest thought on the "bug" question. I have seen it stated, but cannot now lay my hand on the passage, that an eminent surgeon in a European hospital is using the bichloride freely, in a one part to two thousand solution, for vaginal injections and similar purposes. If it can be used in such cases without fear of absorption by the very susceptible mucous membrane of these parts, I see no reason why it may not also be used freely about the mouth, avoiding swallowing it, for all the antiseptic uses of the dentist. I have used it thus to some slight extent in the so-called Rigg's disease, and similar cases, but have not noticed any marked effect, perhaps because I have not been heroic enough. I have no doubt that others have been experimenting in this direction, and I would like to hear from them; every word is now important. The point of the change of the solution into calomel is an important one, and may account for many failures. T. H. C.

HINTS TO WRITERS.

Dr. Billings, U. S. A., and librarian of the Surgeon General's office, gives the following hints to those who write for periodicals:

1. Have something to say.
2. Say it.
3. Stop as soon as you have said it.
4. Give the proper title to your paper.

While all the above are of equal value, we desire to call the particular attention of dental writers to that one which says:

"*Give the proper title to your paper,*" or, in other words, let the title as nearly as possible show what the article treats of.

If you ever have occasion to make an index to dental journals, as we are now doing, you will realize the importance of this seemingly trivial hint; and if you often consult the indexes of our dental magazines, you will as often be tempted, like the Dutchman's son, "*to think dam,*" even though you do not actually utter it about those who, when they report an interesting case of "Necrosis of the Superior Maxilla," give it some such title as a "Case in Practice," as the man who calls his paper "A Rare Case," when, if he had given its proper title of "Alveolar Abscess Involving the Antrum," you could at once tell whether it was what you were looking for or not. Then there is the case of the man who gives his title as "Interesting," when his paper concerns "Dental Statistics in Russia."

Prof. Otis S. Robinson, of the University of Rochester, says, in an article by him on indexing periodical literature: "Think of a valuable historical article on steam navigation, written for one of the British quarterlies at the time the Great Eastern was launched, as indexed under its fancy title: Triton (The) and the Minnows; or, of a long article in the *North American Review*, at the close of the war, reviewing the Rebellion record, as indexed: Scotch the Snake or Kill it; or, Snake, Scotch or Kill it. Some writers have a fancy for such taking titles, and the indexer must be able to reject them promptly, and substitute whatever his own judgment dictates."

Such a title as "A Review," will do well enough when reading a paper before some society, as it rather excites the curiosity of those present as to what is coming; but, when it is published, let a title be given that shows at once the character of the article.

Now I hope the next time *you* write a paper, that, when you have finished it, you will ask yourself, what is my paper about? Then give, in as few words as possible, such a label, that "he who runs may read."

G. L. P.

THE DRILL, OR VENT-HOLE.

Whether the drilling of a so-called vent-hole may be at times justifiable or not, we suppose must be decided by each operator for himself. As for ourselves we have no doubt in regard to it. We have not hesitated in the past, and presume we shall not in the future, at least, till the time comes when a *straight drill* will go straight to the apical foramen of a *crooked root.* We would prefer a clean root filled solid, but when that is *far* from a *possibility,* we find "discretion the better part of valor." But one may inquire, if the drill-hole is decided on, how and in what location of the tooth shall it be drilled?

In our opinion, the location should be just under the margin of the gum, so that the gum will *completely* cover it. This, for two reasons: First, by this means the free entrance of air with the ever present germs is prevented, thus reducing putrescence to the minimum extent. Second, it is less liable to become closed through the forcing in of food or any extraneous matter.

In a single rooted tooth, the drill should take such a direction as to enter the canal at least one-third the distance from the cervix to the apex. In other teeth, sufficiently high, so that the bulbous portion of the canal may be filled without closing the vent. In filling, first place a piece of wire or pin of such length that, when fully in, the head will be close up to the tooth, to prevent filling material being forced so far as to cover the vent. For the molars, a suitably shaped piece of thin platinum may be placed over the opening of the root-canals, in addition to the use of the pin. After the filling, the pin is of course to be removed.

It is just as essential that a vent-hole should be arranged according to correct principles, as the complete filling of roots or of any other operation.

INFLUENCE OF PREGNANCY ON CARIES OF TEETH.

Dr. Dogajew combats the idea that the more common occurrence of diseases of teeth in the pregnant is due to greater absorption of lime-salts. The absorption of lime-salts in the teeth goes on in connection with the development of the granular tissue, as in normal development, in carious processes during elongation of these teeth which have lost their antagonists, and during the resorption in old age. This resorption of lime-salts takes place uninterruptedly from the outer layer to the inner ones, without affecting the normal ones. Dogajew investigated 870 teeth, extracted from pregnants, and found

nowhere a deviation from the other diseases of the teeth. He could also observe that absorption always takes place in the manner indicated. The teeth of children contain less lime-salts than those of adults, yet diseases of the teeth are not more common with them than with the latter. The point of importance seems to be the preservation of the enamel. He finds the disturbances in the *secretive* processes which occur in pregnant women are alone sufficient to account for all the increase in caries; without that, it would be needed to require some special influence only active during the time of pregnancy. There is, of course, but one sure preventive of this affection.

"THE TRUE HISTORY OF RUBBER DAM."

We publish elsewhere, in this number, the statement of Dr. W. T. La Roche, under the above heading, together with the affidavits, which are substantially the same that he read before the First District Dental Society of New York, November 6, 1883, and on which we made editorial comment in the January issue of this journal. We very readily give place to Dr. La Roche, in order that both sides may be accorded a fair hearing and that those who are sufficiently interested may see upon what our strictures were based.

Admitting that Dr. La Roche did invent and personally use, in his own office, rubber dam, in 1857, *what of it?* The profession never heard of it through him, and there is not an iota of evidence that it ever would have done so. Our position was, and is, taken on that point. It is not a matter of interest to the profession, and with this we drop it.

NEWSPAPER ANATOMY.

One of our daily newspapers recently, in reporting an accident where a man was wounded by the contents of a shot-gun, said: "The *cartoid vein* was just missed by forty-six shot which entered the face and neck." A writer in the *Medical Record* made a collection of this class of knowledge as displayed by the non-medical press at the time of Garfield's assassination, from which we select that portion which relates to the glands involved during the progress of the disease: "*Salwary conglomerated*, the *sympathotic*, the *partoid—parotitid—paratodit*, one of which it was feared would *sulphurate*, while in the case of another *suppuration* was expected." G. L. P.

We give in this number the article, by Dr. Miller, that appeared in the *Independent Practitioner*, of February, for two reasons: First, because of its value; Second, because it is an excellent answer to the article that appeared in the January number of the same journal, by the same author, in criticism of a late paper by one of the editors of this journal.

We are obliged, for lack of room, to let our "Book and Pamphlet" notices go over to the next number—also much other matter that we hoped to be able to use in this issue.

CORRESPONDENCE.

Editor New England Journal.

DEAR SIR: I have just been reading an article in the *Southern Dental Journal*, of this month (Jan.), by J. R. W., and hardly know whether to laugh or cry, as either expression might be indulged in feelingly. The old story of *mercurial poisoning* has been harped on for these many years, and seems never to run dry. We have probably heard as much and read as much on the subject as most dentists, and yet have not learned of an identical case where mercurial poisoning was absolutely proved. On the other hand, we have seen precisely the same results in mouths where *black* rubber was worn, and, if mercurial poisoning was present, it came not from the dental plate, but without doubt from the medical practitioner, where it usually finds its source. Have I never seen sore mouths under rubber plates? I am not wilfully blind, and therefore have seen enough to fill one with pity and perhaps anger. It is best, however, to look at things in a candid light, and not with a preconceived opinion, in accordance with which everything must be wrought out. We have employed the various bases on which teeth are mounted, and at times find that probably all of them cause inflammation of the parts covered. If inflammation resulted from a rubber plate of so serious a nature as to require a change, we should hardly rise to advise celluloid, for in this section of country celluloid proves as insidious an enemy as rubber. What would J. R. W. say to the case of a lady who, in about one year from having teeth out and celluloid plate substituted, lost in weight some

seventy-five pounds—she previously weighing about two hundred? After this reduction, the plate was left out for six weeks, and a gain of eight pounds took place. This case we know of, and can attribute the experience to nothing but the celluloid, though it would not be safe to dogmatically declare it such.

We claim that most of the bases in present use have their good features and should be used in their proper places just as much as the different filling materials in theirs. We claim that for the majority of cases a well-constructed gold plate is the most healthful, permanent, and comfortable. In special cases, Reese's metal, Watt's metal, rubber and celluloid, and combinations of the same, have their advantages. If from any circumstances a base may be necessitated which at times gives rise to certain abnormal conditions, the same should be stated to the patient, and guarded against. Then, if the ill results follow, resort to some other base that cannot be appealed from.

From what we many times read and hear, we should infer that the mercury in a red plate must be *immense* in *quantity, and evaporate very rapidly* or, on the other hand, *Homeopathy* takes the lead, and the *high attenuations kill.*

As regards the cancer case mentioned by the writer, we can see nothing decisive about it, and if the M. D. in the case bears any resemblance to the M. D.'s in this section, we should still dissent from the assertion. We have some fine M. D.'s in this section, but, as regards diseases of the mouth, we have lots of "points" on them, and should hardly care to treat cases on the basis of their diagnosis. They have many things to yet learn, as well as ourselves, so it is not best for us to be too fast at "throwing stones," but see to it that we are builded on a sure foundation, and that our house is not "glass."

N. Morgan, D. D. S.

LETTER FROM NEW YORK.

To the Editor of the N. E. J. of Dentistry:

The First District Dental Society had a very instructive and entertaining meeting on Tuesday evening, Feb. 5, President Northrop in the chair, and members and guests to the number of sixty in attendance. The minutes of the last meeting having been read, the report of the chairman of the Clinical Committee, Dr. Bödecker, was given, and the large number of dentists reported as present, about 130, shows the popularity these clinics have deservedly attained. They

are given at the Ninth Street rooms of the S. S. White Dental Manufacturing Co., in the afternoon of the first Tuesday of each month, the First District Society holding their meeting in the evening of the same day.

The clinic of Feb. 5th was particularly interesting, as many peculiar cases met with in private practice were exhibited, some difficult operations were performed by the use of methods peculiar to the operator, and a few new inventions and appliances were shown.

Late in the afternoon, Prof. Louis Elsberg, who will be remembered as one of the first distinguished histologists to accept Carl Heitzmann's views, and who, indeed, suggested to Heitzmann the term "bioplasson" as a name for his "reticulum," gave a very interesting lecture upon "Syphilitic Affections of the Mouth."

After the reading of Dr. Bödecker's report, a prominent member of the society asked the President for information in regard to a number of patents which, within the last few years, have been granted to the so-called "Sheffield Tooth Crown Co." upon processes and methods which he and hundreds of other dentists have used for many years. In the present disgraceful troubles between the Sheffield Company and the Richmonds, said the member, these patents are being pushed into legal prominence and defended as "true blue" first discovery patents. Is there or not, then, he said, danger for us in the future, and are we to be obliged to discontinue the use of methods as old, nearly, as our own professional life, through the existence of patents granted to unscrupulous men upon incomplete evidence?

President Northrop called upon the younger Richmond, ("there are two Richmonds in the field," you know,) who was present, to give what information he could in answer to the member's inquiry, and that gentleman, after considerable personal history, gave it as his opinion that the patents in question were obtained through fraud, his brother, the elder Richmond, having been induced to sign papers the contents of which he knew nothing, and who, now that he had perjured himself, had fled the country.

The members of the profession at large were invited to make the young Richmond's private woes their own, and the use of evidence collected by him for his own defense was offered them with which to fight the objectionable patents.

The essay of the evening was by Dr. W. H. Atkinson, who, at the invitation of the society, had written upon "Loose Teeth," and a masterly presentation of the subject it was. As no course of treat-

ment can be safely decided upon either by the physician or dentist, until he has fully and correctly diagnosed the case, it was particularly fitting that Dr. Atkinson should first trace the gum tissues from health through their pathological changes, and describe and give the different reasons for the loss of the bony sockets of the teeth by necrosis. The essayist advocated the thorough removal of any tartar which might be present, in a careful manner, so as to injure the soft parts as little as possible, quite the reverse of the Rigg's treatment, but of much greater importance does he consider the tying of the teeth one to another with floss silk, and drawing them into the positions they formerly occupied. A stone in the engine should then be used to grind away such portions of the teeth as may interfere with their proper articulation by reason of any elongation which may have taken place, and they should be ground until the occlusion will give pressure upon each tooth in the direction of its axis of greatest strength. This treatment, Dr. Atkinson claims, is enough to cure many cases, as it gives all the teeth their proper share of work, taking away, too, the irritation which their occlusion—when sore, elongated and tipped—causes so constantly, and gives it as his experience that many patients who have not been able to eat a meal for months without suffering great pain, have, the day after such treatment, eaten with comfort and pleasure.

At a subsequent sitting, Dr. Atkinson recommends filling the gum pockets with aromatic sulphuric acid, and in extreme cases inserting an appliance to protect the healing gums from contact with the food, so that the embryonal elements may take on the form of their surroundings and make new gums.

The paper was well received and the discussion quite general.

D.

A CASE IN PRACTICE.

Mrs. G. applied to me to have several teeth and roots extracted, one of which was part of the left upper second bicuspid. I administered nitrous oxide, and left this root for the last. It immediately gave way, and I supposed it had slipped through the forcep. After the flow of blood had ceased, I made an examination of the mouth, and was surprised to find, to all appearances, this root in place. On wiping off the blood with cotton, the root disappeared, falling back into the antrum. After working some time, I at last succeeded in

removing it by cutting away alveolus and some of the root. It was very much like a cork in a bottle, very difficult to hold. Having seen nothing similar reported, this may interest the readers of the JOURNAL.

J. K. W.

SOCIETIES.

VERMONT STATE BOARD OF DENTAL EXAMINERS.

This board will hold their second annual meeting at the Welden House, St. Albans, Vt., Wednesday, March 19, 1884, at 10 A. M. Applicants for license are requested to report promptly at that time. No license will be issued during the session of the Vermont State Dental Society. As this will be the only meeting of the board this year, dentists are requested to notify all who intend to go before the board.

R. M. CHASE, *Sec. Board of Examiners.*

VERMONT STATE DENTAL SOCIETY.

The eighth annual meeting of the Vermont State Dental Society will be held in the parlors of the Welden House, St. Albans, Vt., March 19–21, 1884. Members of other societies, and of the profession generally, are invited to attend and take part in the proceedings.

THOS. MOUND, *Secretary.*

NEW YORK ODONTOLOGICAL SOCIETY.

The February meeting of the Odontological Society of New York was held on the 19th, at the residence of Dr. W. E. Hoag, 3 East 43d street. The paper of Prof. Thomas Fillebrown, of Boston, was the prominent feature of the evening. Subject, "Gold as a Filling Material, and its Manipulation." He advocated the use of gold, and of hand-pressure in its introduction, by a method similar to that of Dr. Shumway, of Plymouth, Mass., but with steel points instead of ivory. The suggestions of the author were commended by several speakers.

Dr. Kingsley showed some very handsome specimens of lower artificial dentures, the teeth being mounted with rubber on cast plates made of an alloy of tin, which he originated and of which he gave the formula.

Dr. J. Morgan Howe spoke briefly on the subject of Antiseptics in general and Dental Surgery, referring especially to the use of iodoform and of peroxide of hydrogen (H_2O_2) in the treatment of certain classes of "dead teeth."

TRANSLATIONS.

MICROBES.

BY DR. H. FOL, OF GENEVA.

[From the Journal de Geneve.]

"The number of substances that are less injurious to man than to micro-parasites is small. The best disinfectant is perfectly useless if too weak a dose be used. For each of these substances there is one proportion which will destroy the germs, and another which will arrest their vegetation but not destroy them. This last dose is the one with which we are generally obliged to content ourselves. The experiments of Koch and Miquel show that the narcotic effect begins to be effective on microbes only when the substance in which they are vegetating contains, among a thousand parts, 95 parts of absolute alcohol, or 70 of borax, or 10 of salycilate of soda, or 3.2 of phenic acid, or 5 of quinine, or 0.6 of bromine, or 0.07 of bichloride of mercury, or 0.05 of oxygenated water, and even these at stated ratios of time. Certain of the substances indicated are useful in these doses; while others, as bromine, are impracticable. But especially let us not forget that the result is not a radical disinfection; it is merely a momentary weakening. Is it still needful to insist on the utter uselessness of too mild doses? We are constantly seeing phenic (carbolic) acid used in less than one part in a thousand with the sole effect of creating a mistaken sense of security. Let me mention another almost unknown antiseptic: essence of terebinthine, which, according to Koch, arrests the vegetation of microbes in a dose of one part in 75,000, a quantity easily endured by man. All these hygienic precautions are bristling with difficulties."

SOLIDIFIED CREOSOTE FOR TOOTH-ACHE.

Creosote is a popular remedy for tooth-ache, but its excessive fluidity often occasions severe accidents. This may be prevented by gelatinizing it by the addition of collodion, 10 parts to 15 of creosote. In this way we get a sort of jelly which, besides being more manageable than plain creosote, forms a varnish which covers the orifice of the troublesome tooth and keeps air and moisture from its exposed nerve. —*Progres Dentaire.*

SELECTIONS.

FERMENTATION IN THE HUMAN MOUTH; ITS RELATION TO CARIES IN THE TEETH.

BY DR. W. D. MILLER, BERLIN, GERMANY.

[Reprinted from the Independent Practitioner.]

During the last two years I have stated at different times and places, as the result of many experiments, that "the first stage of dental caries consists in a decalcification of the tissues of the teeth by acids, which are for the greater part generated in the mouth by fermentation." The object of the investigations described in this and the following papers is to determine this ferment, and the conditions essential to its actions. I shall seek, in what follows, to present no views which are not the legitimate and necessary results of rigid and exact experiment, and I shall give in detail a description of each series of experiments, in order that every one may have an opportunity to judge of the accuracy of the work and the justice of the conclusions drawn from it.

It is, nevertheless, with some hesitancy that I venture to present before the dental profession the results of my last six months' labor, having learned by experience the almost endless number of agents which combine to vitiate such a series of experiments as that which I am about to offer, and the exceeding great care which is necessary in excluding or eliminating all irrelevant factors.

If, therefore, I have been guilty of any oversight, or failed to take all possible precautions to guard against error, I hope that some one will kindly show me where I have gone astray, and put me in the right course again.

The larger apparatus necessary for these experiments are:

1. A large double-walled incubator, with gas regulator for maintaining any desired constant temperature.
2. A Koch sterilizer.
3. A damp chamber. (See Fig. 1.)

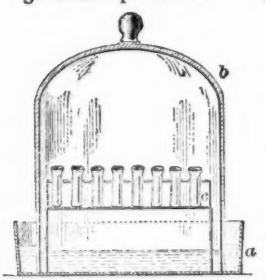

FIG. 1.—Damp Chamber. *a*, shallow glass vessel partially filled with water. *b*, glass globe lined with wet bibulous paper. *c*, metallic stand for culture tubes.

4. A drying oven for sterilizing instruments, glass vessels, etc., at a temperature of one hundred and fifty degrees centigrade.
5. A good microscope, with either water or oil immersion.

It is not necessary to mention the smaller instruments, glass vessels, etc., etc., nor the apparatus necessary for making a chemical analysis of the products of the fermentation; these are sufficiently familiar to every one.

To avoid repetition, I will say here that *all* vessels and instruments used in the

culture experiments were purified in the flame of a Bunsen burner, when practicable, otherwise by exposing for fifteen minutes in the drying oven to a temperature of one hundred and fifty to one hundred and sixty degrees centigrade (three hundred and two to three hundred and twenty degrees Fahrenheit), and that all substances used as culture substrata were sterilized four times by exposure, at intervals of twelve hours, for half an hour, to steam at one hundred degrees centigrade, in a Koch sterilizer. Furthermore, all infections from carious dentine were made as follows: The cavity of a freshly extracted carious tooth is cleared of food, and carefully brushed over with a pledget of cotton dipped in carbolic acid (ninety per cent). The acid is then thoroughly absorbed by means of bibulous paper, and layer after layer of the soft dentine removed with a repeatedly purified instrument, until the deeper parts are reached; then, a portion of the clean soft dentine, scarcely as large as a pin-head, is removed, and quickly brought into or upon the culture medium.

Infections from the mouth were made by scratching upon the surface of the mucous membrane of the cheek, or the margin of the gum, with the end of a clean platinum wire, and then dipping it into the culture medium. The materials used for culture were:

No. 1. Sterilized saliva, 50.0;
Sugar, 1.0;
Starch, 0.5.

No. 2. Sterilized milk.

No. 3. Decoction of malt, 50.0;
Sugar, 1.0.

The malt decoction is made by boiling, with slight evaporation, 20.0 dry malt with 12.0 water for ten minutes and filtering.

No. 4. Sterilized saliva, 50.0;
Water, 50.0;
Starch, 20.0;
Sugar, 2.0.

The starch is added to the cold solution of water and saliva, and stirred until it becomes evenly divided throughout the solution; it is then poured into shallow glass vessels with glass covers, and put into the sterilizer for complete sterilization; it there congeals and forms a solid mass, upon the surface of which the infections may be made. It possesses all the advantages of gelatine, with one great additional one, in that it does not liquify at blood temperature.

No. 5. Decoction of malt, 100.0;
Sugar, 2.0;
Starch, 20.0.
Prepared in the same way as No. 4.
No. 6. Beef extract, 2.0;
Water, 100.0.
No. 7. Water, 100.0;
Beef extract, 2.0;
Sugar, 2.0.

No. 8. Fresh baked potato, cut into slices one-half inch thick, with a clean knife.

Other substances were used, but need not be considered here. Additional sugar is not absolutely necessary where malt is used, though I have, so far, obtained better results by adding a small quantity. The kind of sugar is immaterial, provided it be fermentable; even cane sugar, though not directly fermentable, is converted into a fermentable variety in the culture. Where small quantities of any culture material were used, the cultures were kept in the damp chamber to prevent their drying up or becoming too concentrated by evaporation. All cultures were made under a temperature of thirty-six to thirty-eight degrees centigrade.

We will begin with the fundamental experiments.

Exp. 1. Fresh saliva is mixed with sugar or starch, one to forty, and kept at blood temperature. It invariably becomes acid in four to five hours. But some one, no doubt, will say that this is a result of no consequence, because the experiment was not made within the oral cavity; for his personal benefit we give the following:

Exp. 2. A glass tube two c. m. long and three m. m. wide, is filled with starch, sterilized, and fastened to a molar tooth in the mouth on going to bed; next morning the contents of the tube will have a strong acid reaction. A cavity in a tooth, or a piece of linen, which may be saturated with a solution of starch, will answer the purpose as well as the glass tube. That the acid is the same in each case will be further established below.

Exp. 3. The mixture of saliva with starch or sugar, is kept for a half-hour in the sterilizer at one hundred degrees centigrade, and then placed in the incubator; it does not become sour in four, nor in twenty-four hours; in fact, not at all. We conclude that the ferment is rendered inactive by a temperature of one hundred degrees centigrade.

Exp. 4. The starch is heated to one hundred and fifty degrees centigrade before mixing with the saliva; the solution still becomes sour. Conclusion: the ferment exists, not in the starch, but in the saliva.

We have now to determine the question: Is it an organized ferment (fungi), or is it an unorganized ferment (ptyaline)?

This question is determined by the following experiments:

Exp. 5. From six to eight grams of saliva are agitated in a test-tube with as much sulphuric ether as it will take up, starch added, and the whole put in the incubator. On examination, after a few hours, we will find sugar in the solution, but no acid; in other words, the acid-forming ferment has been rendered inactive; but the unorganized, sugar-forming ferment, not.

Exp. 6. Instead of ether, enough carbolic acid is added to make the solution one-half per cent. strong; the result is the same. These two experiments show that the ptyaline of the saliva (which was not injured by the presence of the ether or the carbolic acid, as proved by the fact that it retained its diastatic action) is not the cause of the acid reaction.

Exp. 7. According to Paschutin, pytaline is devitalized by exposure twenty minutes to a temperature of sixty-seven degrees centigrade. Organized ferments could not be killed by the same means. We accordingly subject a mixture of saliva and grape-sugar to the given temperature for twenty minutes. We thereby destroy the ptyaline; the mixture, nevertheless, becomes sour if allowed to stand in the incubator for twenty hours.

This experiment confirms the result of experiments five and six, and we begin to suspect that we have to deal with an organized ferment. This supposition is confirmed by the following experiment:

Exp. 8. Six to eight drops of a perfectly sterilized solution of sugar in saliva (1-40), in a minature test-tube with cotton cork, are infected from the mouth, or with carious dentine, as described above; in twenty-four hours the solution will be acid; with a fraction of a drop of this solution a second tube is infected; it will likewise become acid; from this a third, etc., etc.; each becomes acid in turn, while the control tube (containing the same solution, not infected) remains neutral.

The conclusion is plain, that we have to do with a ferment which is capable of producing itself; in other words, an organized ferment. It therefore becomes evident that not only free in the mouth, but in

the deeper parts of carious dentine, we have fungus which is capable of producing an acid reaction in characteristic substrata.

Exp. 9. Each of thirty small tubes were furnished with eight drops of solution No. 1, and each of thirty other tubes with as many drops of solution No. 3, and all were sterilized. Twenty-four were then infected from the mouth, twenty-four with carious dentine, and twelve were left as controls.

In twenty-four hours all forty-eight of the infected solutions were acids, while the twelve controls remained neutral.

Exp. 10. Make a solution of 40.0 of saliva and 1.0 of starch; put equal portions in two flasks, *a* and *b*, and cover the surface of the solution in *a* with a layer of pure oil to prevent the free access of air; or:

Exp. 11. Place flask *a* in an air-tight bottle containing a fresh alkaline solution of pyrogallic acid (which abstracts the oxygen from the air;) or:

Exp. 12. Exhaust flask *a* by means of the air pump, so as to produce a tolerably complete vacuum. The quantity of acid produced in *a* will be, on an average, the same as that produced in *b*.

We conclude from experiments eight, nine, and ten, that the fungus in question is independent of the free access of air or oxygen for its development and characteristic action, a conclusion which would exclude the fungus of vinegar (*mycoderma aceti*), and which is of the utmost practical importance, since it signifies that this fungus can develop and perform its work deep in the dentinal tubules, or under fillings, provided the necessary materials are furnished it.

Exp. 13. Place a piece of carious dentine upon the surface of the culture material described in number four, five, or six; in twelve hours the dentine will be surrounded by a white ring, from four to eight m. m. in diameter; the material within this ring will be partially liquified, and have an acid reaction. The same result follows when the infection is made from the mouth.

Exp. 14. Produce 10.0 of saliva by chewing a sterilized quill toothpick, add 0.5 starch or sugar, and place in the incubator. Then give the oral cavity a most thorough cleansing with pure water, using toothpick, brush and floss, the object being to free the mouth from micro-organisms as completely as possible. Then produce again 10.0 saliva, add 0.5 starch or sugar, and put in the incubator. The amount of acid produced in a given time will, in the latter case, be often as low as one-fourth of that in the former. Conclusion: By

thoroughly cleansing the mouth we, no doubt, remove the greater portion of the fungi, hence the small amount of acid produced. By using strong antiseptics, or by repeatedly filtering the saliva, we may reduce the amount of acid produced in twenty-four hours almost to o. An experiment yet to be made is to take the saliva direct from the gland, before it becomes infected with the organisms of the mouth; it should not then become sour when mixed with starch and allowed to stand at blood temperature. In every case a careful microscopic examination of the cultures was made, revealing the constant presence of a fungus, chiefly in the form of diplococci, either single or in chains, less often in form of bacteria, bacilli, or even threads. (See Fig. 2.)

Sometimes all these forms are found on a single thread, thus proving what I have already demonstrated for *leptothrix buccalis* and *leptothrix gigantea* (Miller), the genetic connection of these different forms. The particular form in which the fungus occurs depends somewhat upon the culture medium, as well as upon the age of the culture. By using a glass tube as culture vessel, we may demonstrate that whether the culture is made in the mouth or out of it, under similar conditions the fungus is the same. The fungus is not capable of producing an acid reaction of all substances in which it may vegetate. A luxuriant growth may be obtained in beef extract, but no acid is produced unless sugar is present.

FIG. 2.—Some of the forms in which the fungus, treated of in this article, occurs.

It is only from carbo-hydrates (especially sugar) that it appears to be able to produce acid in any considerable quantity, or at all. This question, however, as well as the morphology, physiology, development and life conditions of the fungus, will receive consideration in a separate number.

We have, then, a micro-organism which agrees morphologically with the *bacterium acidi lactici*, and which, without the presence of oxygen, produces acid from sugar, so that we would probably not be far from right if we were to say that the organism in question is simply the fungus of lactic acid; we will, however, reserve our decision

for the following number, where the analysis of the product of the fermentation will be given, that being the one *sure* method for determining the species of any ferment bacterium.

In all cultures, it is of course essential that the culture-substratum be neutral when the inoculation is made ; should it be acid, it must be neutralized. This is best accomplished by very carefully adding the carbonate of sodium. Without this precaution it would be somewhat difficult to determine whether acid had been produced by the action of the fungus or not.

In the light of these experiments the thorough decalcification of the tooth substance in caries is easily accounted for. The saliva is, no doubt, always, particularly in mouths of uncleanly persons, impregnated with sugar, either taken directly into the mouth, or formed there by the action of the ptyaline of the saliva upon starch. The question of the presumable diastatic action, as well as of a presumable inverting power on the part of the organisms themselves, will be considered in the chapter on Physiology.

Wherever this stagnates between the teeth, in fissures, etc., etc., especially during sleep, it *must* become acid. When a portion of the dentine has become decalcified, it, as is well known, takes up the liquids of the mouth and the fungi with them like a sponge, and the fungi, being independent of the free access of air, go on producing acid within the dentinal tubules. As each layer of dentine becomes softened in turn, the micro-organisms *follow after*, continually producing new acid. Hereby the zone of softened, non-infected dentine is readily understood. The production of acid is entirely independent of the reaction of the saliva as it enters the mouth, hence the uselessness of "testing the saliva" for acids. That the liquid squeezed out of the tubules of *decaying* dentine has an acid reaction, every dentist in America who has a piece of blue litmus paper and is not color-blind, can easily prove for himself.

The result of experiment six plainly shows one cause of the good effects which the profession has seen from the use of carbolic acid.

The fact that a pure culture was obtained in most cases by the first inoculation, seems to indicate that the fungus exists in a state of tolerable purity in the deeper parts of the carious dentine. This question will, however, receive consideration later. The action of the fungus upon substances which contain no carbo-hydrates will also be considered under Physiology.